---
title: "QMM_Assignment4"
author: "Ram"
date: "10/25/2021"
output: word_document

Q2)

1) What is the minimum cost of providing oil to the refineries? Which wells are used to capacity in the optimal schedule?

Supply is 276 TBD and the demand is 274 TBD. So, the demand is not equal to supply. So, we create a dummy variable in the demand side of 2 TBD to make sure that the demand is equal to the supply.

As given in the problem, the minimum objective function is formulated below:

Zmin = 1.52 X1A + 1.60 X1B + 1.40 X1C + 1.70 X2A + 1.63 X2B + 1.55 X2C + 1.45 X3A +
1.57 X3B + 1.30 X3C + 5.15 XA1 + 5.12 XB1 + 5.32 XC1 + 5.69 XA2 + 5.47 XB2 + 6.16 XC2 +
6.13 XA3 + 6.05 XB3 + 6.25 XC3 + 5.63 XA4 + 6.12 XB4 + 6.17 XC4 + 5.80 XA5 + 5.71 XB5 +
5.87 XC5 + 0 X A6 + 0 XB6 + 0 XC6

Constraints:

Supply Constraints
X1A +X1B + X1C = 93
X2A + X2B + X2C = 88
X3A + X3B + X3C = 95

Demand Constraints
XA1 + XB1 + XC1 = 30
XA2 + XB2 + XC2 = 57
XA3 + XB3 + XC3 = 48
XA4 + XB4 + XC4 = 91
XA5 + XB5 + XC5 = 48
XA6 + XB6 + XC6 = 2

Constraints from pumps to refinery

X1A + X2A + X3A = XA1 + XA2 + XA3 + XA4 + XA5 + XA6
X1B + X2B + X3B = XB1 + XB2 + XB3 + XB4 + XB5 + XB6
X1C + X2C + X3C = XC1 + XC2 + XC3+ XC4 + XC5 + XC6
Where, Xij >= 0: i(pumps) = (A, B, C), j= 1,2,3(wells), 1:6(refineries)

Using Ipsolve the optimal solution is 1966.68.

Well 3 has used to the capacity in the optimal schedule.

```{r}
library(lpSolveAPI)
lprec<-make.lp(0,27)
lp.control(lprec,sense='min')
set.objfn(lprec,c(1.52,1.60,1.40,1.70,1.63,1.55,1.45,1.57,1.30,5.15,5.12,
5.32,5.69,5.47,6.16,6.13,6.05,6.25,5.63,6.12,6.17,5.80,5.71,5.87,0,0,0))
add.constraint(lprec,c(1,1,1),"=",93,indices = c(1,2,3))
add.constraint(lprec,c(1,1,1),"=",88,indices = c(4,5,6))
add.constraint(lprec,c(1,1,1),"=",95,indices = c(7,8,9))
add.constraint(lprec,c(1,1,1),"=",30,indices = c(10,11,12))
add.constraint(lprec,c(1,1,1),"=",57,indices = c(13,14,15))
add.constraint(lprec,c(1,1,1),"=",48,indices = c(16,17,18))
add.constraint(lprec,c(1,1,1),"=",91,indices = c(19,20,21))
add.constraint(lprec,c(1,1,1),"=",48,indices = c(22,23,24))
add.constraint(lprec,c(1,1,1),"=",2,indices = c(25,26,27))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)),"=",0,indices=c(1,4,7,10,13,16,19,22,25))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)),"=",0,indices=c(2,5,8,11,14,17,20,23,26))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)),"=",0,indices=c(3,6,9,12,15,18,21,24,27))
solve(lprec)
get.objective(lprec)
get.constraints(lprec)
get.variables(lprec)

```